

Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1.-25. (Cancelled)

26. (Previously Presented) A stage apparatus for scanning an object that includes at least one of a mask and a photosensitive substrate, said stage apparatus being provided to a scanning exposure apparatus that illuminates said mask on which a transfer pattern is formed and scans said mask in a predetermined scanning direction and synchronously scans said substrate in a direction corresponding to said scanning direction, thereby exposing said pattern on said mask onto said substrate, comprising:

a base;

a scanning stage that is movable in said scanning direction on said base;

a fine adjustment stage that is movable within predetermined ranges in said scanning direction and in a direction perpendicular to said scanning direction with respect to said scanning stage, said fine adjustment stage mounting said object thereon, said fine adjustment stage having a movable mirror;

actuators arranged in said scanning direction and in the direction perpendicular to said scanning direction with respect to said scanning stage for driving said fine adjustment stage;

an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said fine adjustment stage with respect to said scanning stage; and

a cooling unit that cools said actuators by circulating a predetermined cooling fluid, said cooling unit circulating said cooling fluid from a portion near an optical path of the light beam from said interferometer toward the actuators.

27. (Previously Presented) An apparatus according to claim 26, wherein said fine adjustment stage mounts said mask thereon, and further comprising a substrate stage on which said substrate is mounted.

28. (Previously Presented) An apparatus according to claim 26, wherein said fine adjustment stage mounts said substrate thereon, and further comprising a mask stage on which said mask is mounted.

29. (Previously Presented) An apparatus according to claim 26, wherein at least one of said actuators is constituted by a pair of subactuators which are parallelly arranged.

30. (Previously Presented) A stage apparatus comprising:
a first stage that is movable linearly in a first direction;
a second stage that is movable in said first direction and in a second direction perpendicular to said first direction with respect to said first stage;
a first actuator having a first coil member and a first magnetic member to drive said second stage with a second thrust in said second direction with respect to said first stage;
and
a second actuator having a second coil member and a second magnetic member to drive said second stage with a first thrust in said first direction with respect to said first stage, said first thrust being larger than said second thrust.

31. (Previously Presented) An apparatus according to claim 30, wherein said first actuator is an electromagnetic actuator of a moving magnet type, and said first coil member of said first actuator is fixed to said first stage.

32. (Previously Presented) An apparatus according to claim 30, wherein said second actuator is an electromagnetic actuator of a moving magnet type, and said second coil member of said second actuator is fixed to said first stage.

33. (Previously Presented) An apparatus according to claim 31, further comprising a cooling unit that cools said first coil member of said first actuator by circulating a cooling fluid.

34. (Previously Presented) An apparatus according to claim 32, further comprising a cooling unit that cools said second coil member of said second actuator by circulating a cooling fluid.

35. (Previously Presented) An apparatus according to claim 33, wherein said second stage has a movable mirror; and further comprising:

an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said second stage with respect to said first stage;

wherein said cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

36. (Previously Presented) An apparatus according to claim 34, wherein said second stage has a movable mirror; and further comprising:

an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said second stage with respect to said first stage; and

wherein said cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

37. (Previously Presented) An apparatus according to claim 30, wherein at least one of said first and second actuators is constituted by a pair of subactuators which are parallelly arranged.

38. (Currently Amended) A stage apparatus comprising:

a first stage that is movable linearly in a first direction;

a second stage that is movable in said first direction and in a second direction perpendicular to said first direction with respect to said first stage;

a base that supports said first stage and said second stage;

a position detector having an interferometer that cooperates with a reflective portion of said second stage, said interferometer being supported by said base;

a first electromagnetic actuator ~~that drives~~ having a first moving member to drive said second stage with a second thrust in said second direction with respect to said first stage; and

a second electromagnetic actuator that is different from said first electromagnetic actuator and has a second moving member to drive said second stage with a first thrust in said first direction with respect to said first stage, said first thrust being different from said second thrust and a weight of said moving member being different from a weight of said second moving member;

said second stage is a guideless stage having no associated guide member, other than said first and second electromagnetic actuators, to guide movement of said second stage in the first and second directions.

39. (Currently Amended) An apparatus according to claim 38, wherein said first ~~electromagnetic actuator is a moving magnet type~~ moving member comprises a magnet member, and a first coil member of said first electromagnetic actuator is fixed to said first stage.

40. (Currently Amended) An apparatus according to claim 38, wherein said ~~second electromagnetic actuator is a moving magnet type~~ moving member comprises a magnet member, and a second coil member of said second electromagnetic actuator is fixed to said first stage.

41. (Previously Presented) An apparatus according to claim 39, further comprising a cooling unit that cools said first coil member of said first electromagnetic actuator by circulating a cooling fluid.

42. (Previously Presented) An apparatus according to claim 40, further comprising a cooling unit that cools said second coil member of said second electromagnetic actuator by circulating a cooling fluid.

43. (Currently Amended) An apparatus according to claim 41, ~~wherein said second stage has a movable mirror; and further comprising:~~
~~————— an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said second stage with respect to said first stage; and~~
wherein said cooling unit circulates said cooling fluid from a portion near an optical path of ~~the~~ a light beam from said interferometer toward said first coil member.

44. (Currently Amended) An apparatus according to claim 42, ~~wherein said second stage has a movable mirror; and further comprising:~~
~~————— an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said second stage with respect to said first stage; and~~
wherein said cooling unit circulates said cooling fluid from a portion near an optical path of ~~the~~ a light beam from said interferometer toward said second coil member.

45. (Previously Presented) An apparatus according to claim 38, wherein at least one of said first and second electromagnetic actuators is constituted by a pair of subactuators which are parallelly arranged.

46. (Currently Amended) A stage apparatus for scanning an object that includes at least one of a mask and a photosensitive substrate, said stage apparatus being provided to a scanning exposure apparatus that illuminates said mask on which a transfer pattern is formed and scans said mask in a predetermined scanning direction and synchronously scans said substrate in a direction corresponding to said scanning direction, thereby exposing said pattern on said mask onto said substrate, comprising:

a base;

a scanning stage that is movable in said scanning direction on said base;

a fine adjustment stage that is movable within predetermined ranges in said scanning direction and in a non-scanning direction perpendicular to said scanning direction with respect to said scanning stage, said fine adjustment stage mounting said object thereon;

~~actuators arranged in said scanning direction and in the direction perpendicular to said scanning direction with respect to said scanning stage, said actuators driving said fine adjustment stage; and~~

a first actuator arranged in said scanning direction to drive said fine adjustment stage in said scanning direction;

a second actuator arranged in said non-scanning direction to drive said fine adjustment stage in said non-scanning direction, a weight of said first actuator being different from a weight of said second actuator; and

a cooling unit that cools said actuators by circulating a predetermined cooling fluid, said cooling unit circulating said cooling fluid from said actuators arranged in the direction perpendicular to said scanning direction with respect to said scanning stage for driving said fine adjustment stage.

47. (Previously Presented) An apparatus according to claim 46, wherein said fine adjustment stage mounts said mask thereon, and further comprising a substrate stage on which said substrate is mounted.

48. (Previously Presented) An apparatus according to claim 46, wherein said fine adjustment stage mounts said substrate thereon, and further comprising a mask stage on which said mask is mounted.

49. (Currently Amended) An apparatus according to claim 46, wherein said ~~actuators arranged in said scanning direction are electromagnetic actuators of~~ first actuator is

a moving magnet type, and a stationary member having a coil of said ~~electromagnetic actuators~~ first actuator is fixed to said scanning stage.

50. (Currently Amended) An apparatus according to claim 46, wherein said ~~actuators arranged in the direction perpendicular to said scanning direction are electromagnetic actuators of~~ second actuator is a moving magnet type, and a stationary member having a coil of said ~~electromagnetic actuators~~ second actuator is fixed to said scanning stage.

51. (Previously Presented) An apparatus according to claim 49, wherein said cooling unit cools said stationary member.

52. (Previously Presented) An apparatus according to claim 50, wherein said cooling unit cools said stationary member.

53. (Currently Amended) An apparatus according to claim 46, wherein at least one of said first and second actuators is constituted by a pair of subactuators which are parallelly arranged.

54. (Previously Presented) A lithographic device comprising in a following order:
a substrate stage that is positionable by a first positioning device parallel to a first direction in order to position a substrate;

an imaging system having a main axis directed parallel to a vertical direction perpendicular to the first direction;

a mask stage that is positionable at least parallel to the first direction by a second positioning device in order to position a mask; and

an illumination optical system that irradiates an exposure illumination light beam;

wherein the second positioning device includes a first actuator that positions the mask stage over a comparatively small movement parallel to the first direction, and a

second actuator that positions the mask stage over a comparatively large movement parallel to the first direction, the first actuator being driven to prevent a positional error of the mask at least when the second actuator is being at least one of accelerated and decelerated.

55. (Previously Presented) A device according to claim 54, wherein said first actuator is an electromagnetic actuator of a moving magnet type, and a stationary member having a coil of said first actuator is fixed to a support.

56. (Previously Presented) A device according to claim 55, further comprising a cooling unit that cools said stationary member by circulating a cooling fluid.

57. (Previously Presented) A device according to claim 56, wherein a portion of said mask stage that moves with a moving magnet of said first actuator has a movable mirror; and further comprising:

an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said portion that moves with said moving magnet relative to said support;

wherein said cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

58. (Previously Presented) A device according to claim 54, wherein said first actuator is an electromagnetic actuator constituted by a pair of subactuators which are parallelly arranged.

59. (Previously Presented) A scanning exposure apparatus that moves a mask with respect to a projection optical system while illuminating said mask on which a transfer pattern is formed and synchronously moves a photosensitive substrate with respect to said projection optical system, thereby projecting and exposing said pattern on said mask onto said substrate through said projection optical system, comprising:

a base that holds the following elements;

a scanning stage that is movable, with respect to said base, along a first direction corresponding to a moving direction of said mask and said substrate;

a fine adjustment stage that is movable along the first direction with respect to said scanning stage, said fine adjustment stage mounting one of said mask and said substrate, and a size of said fine adjustment stage being smaller than a size of said scanning stage; and

an actuator that drives said fine adjustment stage to prevent a positional error between said scanning stage and said fine adjustment stage at least when said scanning stage is being at least one of accelerated and decelerated during a scanning exposure operation.

60. (Previously Presented) An apparatus according to claim 59, wherein said fine adjustment stage mounts said mask thereon, and further comprising a substrate stage on which said substrate is mounted.

61. (Previously Presented) An apparatus according to claim 59, wherein said fine adjustment stage mounts said substrate thereon, and further comprising a mask stage on which said mask is mounted.

62. (Previously Presented) An apparatus according to claim 59, wherein said actuator is an electromagnetic actuator of a moving magnet type, and a stationary member having a coil of said electromagnetic actuator is fixed to said scanning stage.

63. (Previously Presented) An apparatus according to claim 62, further comprising a cooling unit that cools said stationary member of said electromagnetic actuator by circulating a cooling fluid.

64. (Previously Presented) An apparatus according to claim 63, wherein said fine adjustment stage has a movable mirror; and further comprising:

an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said fine adjustment stage with respect to said scanning stage;

wherein said cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

65. (Previously Presented) An apparatus according to claim 59, wherein said actuator is constituted by a pair of subactuators which are parallelly arranged.

66. (Previously Presented) A stage apparatus comprising:
a first stage that is linearly movable in a first direction;
a second stage that is movable in said first direction with respect to said first stage, a size of said second stage being smaller than a size of said first stage; and

an actuator that drives said second stage in said first direction, said actuator driving said second stage at least when said first stage is being at least one of accelerated and decelerated, said actuator having a first portion connected to said first stage and a second portion connected to said second stage.

67. (Previously Presented) An apparatus according to claim 66, wherein said actuator is an electromagnetic actuator of a moving magnet type, and said first portion having a coil.

68. (Previously Presented) An apparatus according to claim 67, further comprising a cooling unit that cools said first portion of said electromagnetic actuator by circulating a cooling fluid.

69. (Previously Presented) An apparatus according to claim 68, wherein said second stage has a movable mirror; and further comprising:

an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said second stage with respect to said first stage;

wherein said cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

70. (Previously Presented) An apparatus according to claim 66, wherein said actuator is constituted by a pair of subactuators which are parallelly arranged.

71. (Previously Presented) A stage driving method for driving, in a predetermined direction, a first stage that is arranged to be movable linearly in a first direction and for driving a second stage that is arranged to be movable at least in said first direction with respect to said first stage, comprising the steps of:

providing an actuator to drive said second stage, said actuator having a first portion connected to said first stage and a second portion connected to said second stage;

driving said first stage; and

driving said second stage to prevent a positional error between said first stage and said second stage at least when said first stage is being at least one of accelerated and decelerated, a size of said second stage being smaller than a size of said first stage.

72. (Previously Presented) A method according to claim 71, wherein said second stage is driven by an electromagnetic actuator of a moving magnet type, and said first portion having a coil.

73. (Previously Presented) A method according to claim 72, further comprising the step of cooling said stationary member of said first portion by circulating a cooling fluid.

74. (Previously Presented) A method according to claim 73, wherein said second stage has a movable mirror, said method further comprising the step of:

irradiating a measurement light beam from an interferometer on said movable mirror to detect a displacement of said second stage with respect to said first stage, wherein a cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

75. (Previously Presented) A method according to claim 71, wherein an electromagnetic actuator that drives said second stage is constituted by a pair of subactuators which are parallelly arranged.

76. (Previously Presented) A stage driving method for scanning an object that includes at least one of a mask and a photosensitive substrate, in a scanning exposure apparatus that illuminates said mask on which a transfer pattern is formed and scans said mask in a predetermined scanning direction and synchronously scans said substrate in a direction corresponding to said scanning direction, thereby exposing said pattern onto said substrate, said method comprising the steps of:

driving a first stage in said scanning direction, said first stage being used for scanning one of said mask and said substrate; and

driving a second stage in said scanning direction by an actuator having a first portion connected to said first stage and a second portion connected to said second stage to prevent a positional error between said first stage and said second stage at least when said first stage is being at least one of accelerated and decelerated during said scanning exposure, said second stage being movable in said scanning direction with respect to said first stage, and said second stage mounting said object thereon, and a size of said second stage being smaller than a size of said first stage.

77. (Previously Presented) A method according to claim 76, wherein said second stage mounts said mask thereon, and said scanning exposure apparatus further comprises a substrate stage on which said substrate is mounted.

78. (Previously Presented) A method according to claim 76, wherein said second stage mounts said substrate thereon, and said scanning exposure apparatus further comprises a mask stage on which said mask is mounted.

79. (Previously Presented) A method according to claim 76, wherein said actuator is of a moving magnet type, and said first portion having a coil.

80. (Previously Presented) A method according to claim 79, further comprising the step of cooling said first portion by circulating a cooling fluid.

81. (Previously Presented) A method according to claim 80, wherein said second stage includes a movable mirror, said method further comprising the step of:

irradiating a measurement light beam from an interferometer on said movable mirror to detect a displacement of said second stage with respect to said first stage, wherein a cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

82. (Previously Presented) A method according to claim 76, wherein said actuator is an electromagnetic actuator that is constituted by a pair of subactuators which are parallelly arranged.

83. (Previously Presented) A method for making an exposure apparatus that transfers a pattern of a mask onto a substrate, comprising the steps of:

providing a substrate stage on which said substrate is mounted;

providing a first positioning device that positions said substrate stage parallel to a first direction;

providing an imaging system having a main axis directed parallel to a vertical direction and perpendicular to the first direction;

providing a mask stage on which said mask is mounted;

providing a second positioning device that positions said mask stage at least parallel to the first direction; said second positioning device having a first actuator that positions said mask stage over a comparatively small movement parallel to the first direction, and a second actuator that positions said mask stage over a comparatively great movement

parallel to the first direction, the first actuator being driven at least to prevent a positional error of said mask when the second actuator is being at least one of accelerated and decelerated; and

providing an illumination optical system that irradiates an exposure illumination light beam.

84. (Previously Presented) A method according to claim 83, wherein said first actuator is an electromagnetic actuator of a moving magnet type, and a stationary member having a coil of said electromagnetic actuator is fixed to a support.

85. (Previously Presented) A method according to claim 84, further comprising the step of providing a cooling unit that cools said stationary member of said electromagnetic actuator by circulating a cooling fluid.

86. (Previously Presented) A method according to claim 85, wherein a portion of said mask stage that moves with a moving magnet of said electromagnetic actuator has a movable mirror; and further comprising the step of:

providing an interferometer that irradiates a measurement light beam on said movable mirror to detect a displacement of said portion of said mask stage that moves with said moving magnet relative to said support, wherein said cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

87. (Previously Presented) A method according to claim 83, wherein said first actuator is constituted by a pair of subactuators which are parallelly arranged.

88. (Previously Presented) A method of operating an exposure apparatus to transfer a pattern on a mask onto a substrate, the apparatus having a projection optical system, a first stage that is movable along a first direction with respect to the projection optical system, and a second stage that is movable along the first direction with respect to the first

stage, the second stage mounting one of said mask and said substrate thereon, the method comprising the steps of:

driving the first stage in the first direction; and

driving the second stage in the first direction to prevent a positional error between said first stage and said second stage at least when the first stage is being at least one of accelerated and decelerated, a size of the second stage being smaller than a size of the first stage.

89. (Previously Presented) A method according to claim 88, wherein said second stage mounts said mask thereon, and said exposure apparatus further comprises a substrate stage on which said substrate is mounted.

90. (Previously Presented) A method according to claim 88, wherein said second stage mounts said substrate thereon, and said exposure apparatus further comprises a mask stage on which said mask is mounted.

91. (Previously Presented) A method according to claim 88, wherein an electromagnetic actuator that drives said second stage is of a moving magnet type, and a stationary member having a coil of said electromagnetic actuator is fixed to said first stage.

92. (Previously Presented) A method according to claim 91, further comprising the step of cooling said stationary member of said electromagnetic actuator by circulating a cooling fluid.

93. (Previously Presented) A method according to claim 92, wherein said second stage includes a movable mirror, said method further comprising the step of:

irradiating a measurement light beam from an interferometer on said movable mirror to detect a displacement of said second stage with respect to said first stage, wherein a cooling unit circulates said cooling fluid from a portion near an optical path of the light beam from said interferometer toward a distant portion.

94. (Previously Presented) A method according to claim 88, wherein said second stage is driven by an electromagnetic actuator that is constituted by a pair of subactuators which are parallelly arranged.

95. - 96. (Cancelled)

97. (Previously Presented) A semiconductor element made by utilizing the lithographic device of claim 54.

98. (Previously Presented) A liquid crystal display element made by utilizing the lithographic device of claim 54.

99. (Previously Presented) A semiconductor element made by utilizing the scanning exposure apparatus of claim 59.

100. (Previously Presented) A liquid crystal display element made by utilizing the scanning exposure apparatus of claim 59.

101. (Previously Presented) A method of making a semiconductor element comprising utilizing the exposure apparatus made by a method according to claim 83.

102. (Previously Presented) A method of making a semiconductor element comprising operating an exposure apparatus according to claim 88.

103. (Previously Presented) A method of making a liquid crystal display element comprising utilizing the exposure apparatus made by a method according to claim 83.

104. (Previously Presented) A method of making a liquid crystal display element comprising operating an exposure apparatus according to claim 88.